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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/728,649

12/05/2003

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42P17015

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01/12/2009

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EXAMINER

TANG, KENNETH

ART UNIT

PAPER NUMBER

2195

MAIL DATE

DELIVERY MODE

01/12/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/728,649	Applicant(s) WANG ET AL.	
	Examiner KENNETH TANG	Art Unit 2195	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 November 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

1. Claims 1-30 are presented for examination.
2. This action is in response to the Amendment/Remarks on 11/6/08. Applicant's arguments have been fully considered but are moot in view of the new grounds of rejections.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-13, 25 and 30 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
 - a. As to claim 1, the term "light-weight" is a relative term which renders the claim indefinite. The term "light-weight" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Claims 2-13 are also rejected as being dependent upon rejected claim 1.
 - b. As to claim 25, the term "minimal context information" (line 3) is a relative term which renders the claim indefinite. The term "minimal context information" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Furthermore, there lacks antecedent basis for "the minimal context information". It is unclear how the minimal context information is restored being

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that it is not clear how the minimal context information was initially used in the first place.

c. Claim 30 recites the limitation "the user-marking instruction" in line 5. There is insufficient antecedent basis for this limitation in the claim. Claim 30 depends on claim 28, but it is unclear if it should depend on claim 29 because that claim does have antecedent basis. Since the scope of the claim cannot be ascertained, the claim is found to be indefinite.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claims 14-16 and 18-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Wang et al. (hereinafter Wang) (US 2002/0144083 A1).**

5. As to claim 14, Wang teaches a system comprising:

a memory to hold an instruction (registers) (page 3, [0044], lines 1-10); and

a processor coupled to the memory (registers are coupled to the processor) (Fig. 1, items 100, 102, 112), including raw event detection logic to detect at least one raw event, a user-addressable register to specify a user-defined trigger event based on the at least one raw event, a switch handler to invoke a helper thread (spawning a speculative thread via an event trigger)

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responsive to the occurrence of the user-defined trigger event (page 2, [0030], Abstract, page 3, [0047], page 5, [0065]).

6. As to claim 15, Wang teaches wherein: the instruction includes a marking instruction, when executed, to specify the user-defined trigger event in the user-addressable register (page 4, [0055], lines 1-8).

7. As to claim 16, Wang teaches wherein: the instruction is a trigger instruction; and raw event detection logic is to detect an opcode of the trigger instruction when the trigger instruction reaches an execution phase of an execution pipeline (page 2, [0032] and [0037]).

8. As to claim 18, Wang teaches wherein: the switch handler is further to maintain minimal context information for a current thread before invoking the helper thread, wherein the minimal context information includes a context weight less than a full context weight by at least a weight of excluding traditional context information (context switching without incurring any overhead cycles) (page 4, [0061]).

9. As to claim 19, Wang teaches wherein: the excluded traditional context information further comprises general register values (page 3, [0044]).

10. As to claim 20, Wang teaches wherein the minimal thread context information comprises an instruction pointer address value (page 6, [0085], lines 5-9).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 1-7 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (hereinafter Wang) (US 2002/0144083 A1) in view of Jones et al. (hereinafter Jones) (US 2005/0107986 A1).

12. As to claim 1, Wang teaches an apparatus comprising:

a trigger-response mechanism that includes at least one bank of user-programmable registers to identify a user-defined trigger event (page 3, [0044], page 2, [0030]); and

thread switch handler logic coupled to the trigger-response mechanism to perform a light-weight thread (threads are by definition light-weighted vs. processes are heavy-weighted) switch

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from a first thread to a second thread (switching from main thread to the spawned speculative thread via triggers) (Abstract, page 4, [0055], page 5, [0065]).

13. Wang is explicitly silent that the thread switching occurs responsive to the user-defined trigger event occurring during execution of the first thread. However, Jones teaches thread switching being done responsive to user-defined trigger events occurring during execution of the first thread via the use of user-programmable registers ([0023]-[0026]). Wang and Jones are analogous art because they are both in the same field of endeavor of thread processing. One of ordinary skill in the art would have known to modify Wang such that it would include the feature of the thread switching responsive to the user-defined trigger event occurring during execution of the first thread, as taught in Jones. The suggestion/motivation for doing so would have been to provide the predicted result of an improved performance monitoring, as disclosed in Jones ([0003], [0009]). Therefore, it would have been obvious to one of ordinary skill in the art to combine Wang and Jones to obtain the invention of claim 1.

14. As to claims 2-3, Wang is silent in synchronous and asynchronous triggering of events. However, Official Notice is taken that synchronous and asynchronous processing are well known and with each having distinct advantages. For example, asynchronous processing returns control to the user program without waiting for an I/O to complete. The I/O then can continue while other system operations occur. On the other hand, synchronous processing returns the control to the user process and is more simpler than asynchronous processing. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Wang to include

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the features of synchronous and asynchronous processing to achieve the benefit as described above.

15. As to claim 4, Wang (page 4, [0064]) and Jones (see Fig. 3) teaches wherein the thread switch handler logic to perform a light-weight switch from the first thread to the second thread comprises: saving a first instruction pointer address for the first thread before setting a second instruction pointer address for the second thread. In a context switch, the state of the first process must be saved somehow, so that, when the scheduler gets back to the execution of the first process, it can restore this state and continue.

16. As to claim 5, Wang further comprising: a task queue to receive the first instruction pointer address (Fig. 1, item 110, [0080], [0085]).

17. As to claim 6, Wang teaches wherein: the task queue further comprises a memory location (page 3, [0044]).

18. As to claim 7, Wang teaches wherein: the task queue further comprises a register (page 3, [0044]).

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19. As to claim 10, Wang teaches wherein the thread switch handler logic is to perform the light-weight thread switch from the first thread to the second thread transparently to an Operating System (OS) and without OS intervention. (page 5, [0065], page 4, [0064]).

20. As to claim 11, Wang teaches wherein: the thread switch handler is further to save a light weight context for the first thread in a memory location before performing the light-weight context switch from the first thread to the second thread (page 3, [0044]). In a context switch, the state of the first process must be saved somehow, so that, when the scheduler gets back to the execution of the first process, it can restore this state and continue.

21. As to claim 12, Wang teaches wherein: the thread switch handler is further to save a light weight context for the first thread in a register before performing the light-weight context switch from the first thread to the second thread (page 3, [0044]). In a context switch, the state of the first process must be saved somehow, so that, when the scheduler gets back to the execution of the first process, it can restore this state and continue.

22. **Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (hereinafter Wang) (US 2002/0144083 A1) in view of Jones, and further in view of Hugly (US 2002/0138706 A1).**

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23. As to claim 8, Although Jones discloses the prevention of problems from non-atomic processor events detected by counters ([0012], [0040]), Jones and Wang are explicitly silent in further comprising: a plurality of event counters coupled to the trigger-response mechanism, wherein each event counter is to detect an atomic processor event. However, Hugly teaches exception handling and context switching wherein a plurality of event counters are coupled to the switching mechanism, wherein each event counter detects an atomic processor event ([0041]-[0043], [0045]). One of ordinary skill in the art would have known to modify Wang and Jones to include using a plurality of event counters. The motivation/suggestion for doing so would have been to improve the handling of any access conflicts, thus improving control and reducing overhead, as stated in Hugly ([0008]). Therefore, it would have been obvious to combine Hugly with Wang and Jones to obtain the invention of claim 8.

24. As to claim 9, Hugly teaches trigger events being based on one or more of the atomic processor events ([0041]-[0043], [0045]).

25. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (hereinafter Wang) (US 2002/0144083 A1) in view of Jones et al. (hereinafter Jones) (US 2005/0107986 A1), and further in view of Spix et al. (hereinafter Spix) (US 6,195,676).

26. As to claim 13, Wang teach further comprising: one or more user-programmable control registers coupled to the thread switch handler (see rejection of claim 1). Wang and Jones are

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silent in teaching the value of the one or more control registers to indicate the weight of context information. However, Spix teaches context switching wherein the amount of context information in the registers are indicated and classified as lightweight, for example (col. 3, lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). One of ordinary skill in the art would have known to modify Wang and Jones to include Spix's feature of identifying weights of context information for the use of context switching. The motivation/suggestion for doing so would have been to minimize total context switch overhead and minimizing the delays and bottlenecks by classifying the amount of context information (weights) and context switching according to those weights (col. 3, lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). Therefore, it would have been obvious to combine Jones, Wang and Spix to obtain the invention of claim 13.

27. Claims 17 and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (hereinafter Wang) (US 2002/0144083 A1) in view of Spix et al. (hereinafter Spix) (US 6,195,676).

28. As to claim 17, Wang teach further comprising: one or more user-programmable control registers coupled to the thread switch handler (see rejection of claim 1). Wang is silent in teaching the value of the one or more control registers to indicate the weight of context information. However, Spix teaches context switching wherein the amount of context information in the registers are indicated and classified as lightweight, for example (col. 3, lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). One of ordinary skill in the art would have

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known to modify Ahmad and Ranganathan to include Spix's feature of identifying weights of context information for the use of context switching. The motivation/suggestion for doing so would have been to minimize total context switch overhead and minimizing the delays and bottlenecks by classifying the amount of context information (weights) and context switching according to those weights (col. 3, lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). Therefore, it would have been obvious to combine Spix with Wang to obtain the invention of claim 17.

29. As to claim 28, Wang teaches a processor comprising:

event detection logic to detect a raw event (switch-on-event based on event triggers)
(page 2, [0030], [0047]);

user-programmable event logic coupled to the event detection logic to indicate a user-defined trigger event, the user-defined trigger event to be based on at least the raw event (page 2, [0030], page 5, [0065]);

thread switch logic coupled to the user-programmable event logic and context control logic, the thread switch logic, in response the user-defined trigger event being detected, to save a portion of a first context to be saved that is to be specified in the user-programmable context control logic and to spawn a helper thread without operating system intervention (page 5, [0064]-[0065]).

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30. Wang is silent in taking into consideration the weight of the context. However, Spix teaches context switching wherein the amount of context information in the registers are indicated and classified as lightweight, for example (col. 3, lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). One of ordinary skill in the art would have known to modify Ahmad and Ranganathan to include Spix's feature of identifying weights of context information for the use of context switching. The motivation/suggestion for doing so would have been to minimize total context switch overhead and minimizing the delays and bottlenecks by classifying the amount of context information (weights) and context switching according to those weights (col. 3, lines 9-35, col. 14, lines 66-67 through col. 15, lines 1-6). Therefore, it would have been obvious to combine Spix with Wang to obtain the invention of claim 28.

31. As to claim 29, Wang teaches wherein the user-programmable event logic includes at least a user-programmable event register, and wherein the user-defined trigger event is to be programmed in the user-programmable event register in response to execution of a user marking instruction (page 4, [0055]). In addition, Spix teaches the use of marking instructions in event processing (col. 45, lines 37-53).

32. As to claim 30, Wang teaches further comprising trigger response logic coupled to the user-programmable event logic and the event detection logic to detect the user-defined trigger event based on at least the raw event, wherein the trigger response logic is to monitor for the

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user-defined trigger event for a predetermined timeout period after execution of the user-marking instruction (page 3, [0047], lines 6-20).

33. Claims 21-23 and 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kissell (US 2005/0050395 A1) in view of Jones et al. (hereinafter Jones) (US 2005/0107986 A1).

34. As to claim 21, Kissell teaches a method comprising:

detecting a trigger condition (a miss occurrence or if thread 212 stalls, for example) (page 1, [0011], lines 14-23);

suspending execution of a first thread on a single-threaded processor (thread to be suspended and another thread activated) (page 2, [0014], lines 3-4);

utilizing hardware to save minimal context information (minimum possible overhead) for the current thread without operating system intervention (page 2, [0020], lines 4-8); and

invoking a second thread on the single-threaded processor without operating system intervention (creating thread by using a FORK command or switching from one thread to another) (page 2, [0020], lines 6-10, page 1, [0013], lines 2-4).

35. Wang is explicitly silent that the thread switching from a first thread to a second thread happens wherein the context information has a first weight that is user-defined in a user-

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addressable control register. However, Jones teaches thread switching being done responsive to user-defined trigger events occurring during execution of the first thread via the use of user-programmable registers ([0023]-[0026]). Kissell and Jones are analogous art because they are both in the same field of endeavor of thread processing. One of ordinary skill in the art would have known to modify Kissell such that it would include the feature of the thread switching responsive to the user-defined trigger event occurring during execution of the first thread, as taught in Jones. The suggestion/motivation for doing so would have been to provide the predicted result of an improved performance monitoring, as disclosed in Jones ([0003], [0009]). Therefore, it would have been obvious to one of ordinary skill in the art to combine Kissell and Jones to obtain the invention of claim 21.

36. As to claims 22-23 and 26, Kissell teaches wherein: detecting a user-specified trigger condition further comprises determining that an asynchronous condition specified in a marking instruction (privileged instruction, etc.) has been encountered (page 6, [0093] and [0097]). Jones discloses the prevention of problems from non-atomic processor events detected by counters ([0012], [0040]).

37. As to claim 25, Kissell teach further comprising: determining that the first thread should be resumed; restoring the minimal context information for the first thread; and resuming execution of the first thread without operating system intervention (page 5, [0085], page 6, [0104], lines 1-13).

38. As to claim 27, Kissell teaches wherein detecting a user-specified trigger condition further comprises: generating an asynchronous response to indicate that the second thread should be invoked (page 6, [0093]).

39. Claim 24 is rejected under 35 U.S.C. 102(e) as being unpatentable over Kissell (US 2005/0050395 A1) in view of Jones et al. (hereinafter Jones) (US 2005/0107986 A1), and further in view of Saville et al. (hereinafter Saville) (US 6,401,155 B1).

40. As to claim 24, Kissell and Jones are silent wherein the first weight includes only an instruction pointer address. However, Saville teaches that it is well known that by storing in memory locations not contexts themselves, but pointers to the contexts, this provides a high degree of versatility. It also enables memory to be conserved by storing in only one memory location a context which have common context (col. 2, lines 5-16). Therefore, it would have been obvious to one of ordinary skill in the art to modify Kissell and Jones such that the first weight would include only an instruction pointer address, as taught in Saville. The suggestion/motivation for doing so would have been to provide the predicted result of increased versatility as well as improved memory management, as taught in Saville (col. 2, lines 5-16). Therefore, it would have been obvious to one of ordinary skill in the art to combine Kissell, Jones, and Saville to obtain the invention of claim 24.

Response to Arguments

41. During patent examination, the pending claims must be “given their broadest reasonable interpretation consistent with the specification.” *In re Hyatt*, 211 F.3d 1367, 1372, 54 USPQ2d 1664, 1667 (Fed. Cir. 2000). Applicant always has the opportunity to amend the claims during prosecution, and broad interpretation by the examiner reduces the possibility that the claim, once issued, will be interpreted more broadly than is justified. *In re Prater*, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969).

42. Applicant’s amendments to the claims have overcome the claim objections.

43. Applicant’s amendments to the claims have overcome most of the 35 USC 112, 2nd paragraph rejections from the previous office action. However, the amendments have prompted new grounds of rejections based on 35 USC 112 2nd paragraph with regards to claims 1-13, 25 and 30 (see rejection above).

44. Applicant’s arguments have been fully considered but are moot in view of the new grounds of rejections.

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45. Applicant's amendment to the claims prompted new grounds of rejections, which render the remaining arguments moot.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- **Gaertner et al. (US 5,390,329)** discloses maintaining minimal context information in context switching system with the benefit of processing switches economically (see Abstract).
- **DeBruler (US 4,539,637)** discloses that is well known to store only the address of the program function context, and to store the address of the program function, or a pointer to such an address, in the program function context (col. 12, lines 28-31).
- **Hass (US 2005/0044323 A1)** discloses the use of user-programmable registers in thread switching (see claims 8, 11, 14).
- **Moyer et al. (US 2003/0226001 A1)** discloses the user of user-programmable registers in thread switching (see Abstract, [0020]).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KENNETH TANG whose telephone number is (571)272-3772. The examiner can normally be reached on 8:30AM - 6:00PM, Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Meng-Ai An can be reached on (571) 272-3756. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/VAN H NGUYEN/
Primary Examiner, Art Unit 2194

/Kenneth Tang/
Examiner, Art Unit 2195